Section I: The Study of Professional Development and Teacher Change: Building on National, Cross-Sectional Finding with Longitudinal Data

Excerpted From: Does Professional Development Change Teaching Practice? Results from a Three-Year Study.

U.S. Department of Education, Office of the Under Secretary

Over the past decade, a large body of literature has emerged on professional development, teacher learning, and teacher change.[1] The research literature contains a mix of large- and small-scale studies, including intensive case studies of classroom teaching, evaluations of programs designed to improve teaching and learning, and surveys of teachers about their preservice preparation and in-service professional development experiences.[2] In addition, there is a considerable amount of literature describing "best practices" in professional development, drawing on expert experiences (e.g., Loucks-Horsley et al., 1998). Despite the amount of literature, however, relatively little systematic research has been conducted on the *effects* of professional development on improving teaching or on improving student outcomes.

Although relatively little research has been conducted on the effects of alternative forms of professional development, the research that has been conducted, along with the experience of expert practitioners, provides some preliminary guidance about the characteristics of high-quality professional development. Characteristics of professional development that are identified as "high quality" or "effective" include a focus on content; in-depth, active learning opportunities; links to high standards, opportunities for teachers to engage in leadership roles; extended duration; and the collective participation of groups of teachers from the same school, grade, or department. (See, in particular, Garet et al., 1999; Hiebert, 1999; Loucks-Horsley et al., 1998; U.S. Department of Education, 1999b.)

Although lists of characteristics such as these commonly appear in the literature on effective professional development, there is little direct evidence on the extent to which these characteristics are related to better teaching and increased student achievement.

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Some studies conducted over the past decade suggest that professional development experiences that share all or most of these characteristics can have a substantial, positive influence on teachers' classroom practice and student achievement.[3] Several recent studies have begun to examine the relative importance of specific dimensions or characteristics of professional development. For example, a number of recent studies suggest that the intensity and duration of professional development is related to the degree of teacher change (Shields, Marsh, & Adelman, 1998; Weiss, Montgomery, Ridgway, and Bond 1998). Furthermore, there is some indication that professional development that focuses on specific mathematics and science content and the ways students learn such content is especially helpful, particularly for instruction designed to improve students' conceptual understanding (Cohen & Hill, 1998; Fennema et al., 1996). However, few studies have explicitly compared the effects of different forms of professional development on teaching and learning.[4] Further, most studies of professional development have not examined its effects on a national scale.

Given the need for new, systematic research on the effectiveness of alternative strategies for professional development, we designed our evaluation of the Eisenhower Professional Development Program to enable us to examine the relationship between professional development and change in teaching practice in both a cross-sectional, national probability sample of teachers and a smaller, longitudinal sample of teachers. The Eisenhower program can then be evaluated in terms of the frequency with which program funds are used to provide professional development with features found to be effective. The results from our national sample of teachers are

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described in detail in our second-year report, *Designing Effective Professional Development: Lessons from the Eisenhower Program* (Garet et al., 1999). Below we summarize these results and explain how they serve as

the foundation for our longitudinal study of teachers.

What We Know About Eisenhower Professional Development and Teacher Outcomes: Lessons from Our National Data

The Longitudinal Study of Teacher Change is designed to build on the national, cross-sectional data that we examined in detail in our second-year report. In Garet et al. (1999), we described results from our Teacher Activity Survey, a mail survey of a national probability sample of 1,027 teachers who participated in 657 Eisenhower-assisted activities during the 1997–98 school year.[5] We used the survey of teachers' professional development activities to assess the effectiveness of Eisenhower-assisted activities, examine the quality of Eisenhower-assisted activities, and assess the strength of the relationships between features of the activities in which teachers participated and teachers' self-reported outcomes.

To measure the quality of Eisenhower-assisted activities, we integrated and operationalized the ideas in the literature on "best practices" in professional development. We focused on three "structural features," or characteristics of the structure of a professional development activity. These structural features include the form or organization of the activity—that is, whether the activity is organized as a **reform type,** such as a study group, teacher network, mentoring relationship, committee or task force, internship, individual research project, or teacher research center, in contrast to a traditional workshop, course, or conference; the **duration** of the activity, including the total number of contact hours that participants are expected to spend in the activity, as well as the span of time over which the activity takes place; and the degree to which the activity emphasizes the **collective participation** of groups of teachers from the same school, department, or grade level, as opposed to the participation of individual teachers from many schools.

In addition to these structural features, we focused on three "core features" or characteristics of the substance of the professional development experience itself: the extent to which the activity offers opportunities for **active learning—**that is, opportunities for teachers to become actively engaged in the meaningful analysis of teaching and learning, for example, by reviewing student work or obtaining feedback on their teaching; the degree to which the activity promotes **coherence** in teachers' professional development, by incorporating experiences that are consistent with teachers' goals, aligned with state standards and assessments, and encourage continuing professional communication among teachers; and the degree to which the activity has a **content focus—**that is, the degree to which the activity is focused on improving and deepening teachers' content knowledge in mathematics and science.

- We found that the six key features of high-quality professional development led to increases in teachers' self-reported knowledge and skills and changes in teaching practice: three structural features (characteristics of the structure of the activity)—reform type, duration, and collective participation— and three core features (characteristics of the substance of the activity)—active learning, coherence, and content focus. Our national data allowed us to examine how these features of professional development operate to affect teacher outcomes. We used a statistical technique, ordinary least squares regression (OLS), to estimate a formal causal model, which showed that the structural features of professional development activities influenced the core features of the activities and that the core features, in turn, influenced how successful the experience was in increasing teacher-reported growth in knowledge and skills and changes in teaching practice. For example, as Exhibit 2 shows, activities of longer duration tended to place more emphasis on deepening teachers' content knowledge, provide more opportunities for teachers to engage in active learning experiences, and provide activities that are more coherent. Similarly, activities with greater collective participation of teachers also tended to place more emphasis on content, provide more opportunities for active learning, and offered more coherent professional development than other activities. In turn, professional development that was content-focused and coherent and had active learning was more successful in improving teacher knowledge and eliciting changes in teachers' classroom practices.

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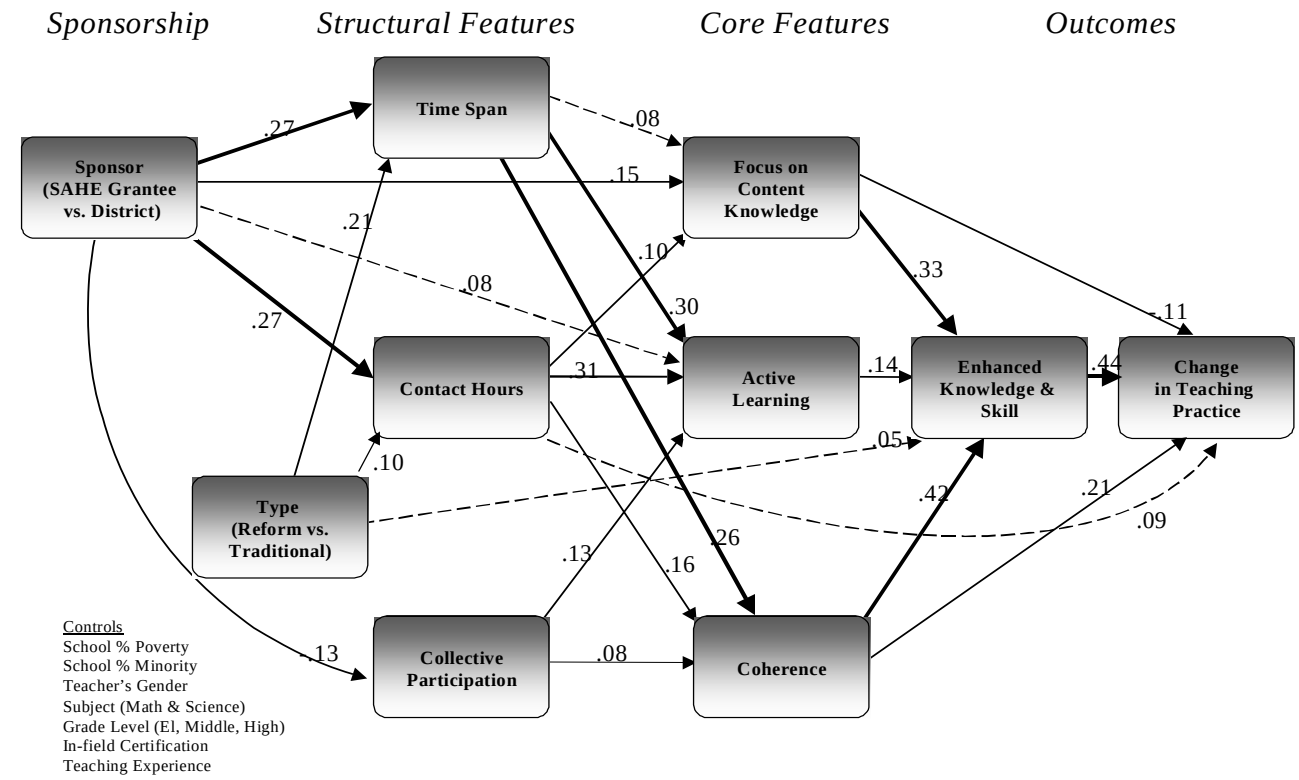
The features of high-quality professional development identified in our national data, while consistent with ideas articulated in the Eisenhower legislation, deepen and extend those

Exhibit 2.

The relationship Between Features of Professional Development and Teacher Outcomes



ideas by providing details about what makes professional development effective. For example, the Eisenhower legislation promotes professional development that is linked to other reform efforts in a coherent, systematic way. The results from our national data show the effectiveness of specific dimensions of coherence, such as discussing professional development experiences with colleagues, and participating in follow-up activities that build on previous activities.

Further, with our national data from district Eisenhower coordinators, we found significant differences between districts in the quality of professional development they provide. We found these differences both in the features of the activities provided—such as active learning, collective participation, and the span of time over which the activities extend—and in district management strategies, including alignment with standards and assessments, frequency of co-funded projects, and a commitment to continuous improvement. Generally, we found that larger districts are more likely to provide high-quality professional development than are smaller districts. (See Garet et al., 1999, for more details on these findings.)

The Purpose and Design of the Longitudinal Study of Teacher Change

Our confidence in these results is strong, given that the data are from a national probability sample. And although the data are based on teacher self-reports, we have confidence in the validity of the data because we did not ask teachers to judge the characteristics of the activities that influenced their effectiveness; instead we asked teachers to describe the characteristics of the activities they experienced, and we asked them whether the activities had an effect on their knowledge, skills,

and classroom practice. Then, through data analysis techniques (e.g., ordinary least squares (OLS) regression), we identified characteristics that were associated with the effectiveness of the activities. Because teachers were not asked to judge the quality of the professional development in which they participated, the study minimizes self-report bias (e.g., Mullens & Gayler, 1999; Mullens, 1998). In addition, the substantial variation in the responses that teachers and district administrators provided to these behavioral items, as well as the consistency in teacher and district administrator responses, provides support for the validity of the data.

The purpose of the Longitudinal Study of Teacher Change is to examine the effects of Eisenhower-assisted and other professional development on teaching practice in mathematics and science.

Although these data showed significant relationships between professional development and changes in teaching practice, the data are cross-sectional (i.e., they were collected at only one point in time). A stronger method of attributing changes in teaching practice to professional development experiences is to gather longitudinal data on teaching practice and experiences in professional development. The Longitudinal Study of Teacher Change was designed to build on these findings from our national, cross-sectional data. With longitudinal data, we can add to our knowledge drawn from the national data. The longitudinal data enable us to document teaching practice before and after a professional development activity and to examine the extent to which changes in teaching practice can be attributed to participation in the professional development activity.

The purpose of the Longitudinal Study of Teacher Change is to examine the effects of Eisenhower-assisted and other professional development on teaching practice in mathematics and science. We do not hypothesize, and so do not test, direct effects of professional development on student achievement; rather, we examine the direct effects of professional development on teachers' instruction. In the LSTC, we use detailed measures of teaching practice that we collected by surveying teachers at three points in time: the fall of 1997, the spring of 1998, and the spring of 1999. Although our study does not measure the effects of professional development on student achievement directly, the measures of teaching practice that we use have been associated with gains in student achievement. (We discuss the measures in more detail in Section III of this report.)

The Sample of Schools

We expected systematic differences in results by school level, so we chose one elementary school, one middle school, and one high school in each of the 10 districts we studied to allow the analysis of results by school level. Further, by design, the sample of 30 schools in the Longitudinal Study of Teacher Change is disproportionately high-poverty—17 of the sample schools, or 57 percent, are high-poverty; nationwide, 25 percent of schools are high-poverty (defined as 50 percent or more students eligible for free lunch).[6] This feature of the sample is useful in an evaluation of the Eisenhower program because the program targets teachers in high-poverty schools.

In addition, we sought schools in which teachers were likely to participate in Eisenhower-assisted activities over the 1997–98 school year, the year in which we conducted site visits to all 30 schools.[7] We selected states, districts, and schools in the sample that had adopted diverse approaches to professional development in addition to traditional workshops and conferences. If such professional development is more effective than traditional approaches, then the teachers' instruction in the sample schools might be better than that of the average teacher. A few of the 30 schools experienced achievement gains in 4th and 8th grade mathematics during the study period (1996–99), some experienced a decline in scores, and others remained at the same level. (See Appendix A for a list of the 4th and 8th grade achievement scores for 1996–99 for each of the 30 schools).[8]

In sum, the longitudinal sample was selected to maximize the opportunity to investigate important differences in approaches to professional development using Eisenhower funds. The sample is not nationally representative, but neither is it extremely unusual. It allows an exploratory, in-depth examination of the characteristics of professional development that foster teacher change. Our longitudinal data complement our earlier nationally representative data. The national data documented the frequency with which Eisenhower professional development has specific characteristics, and our longitudinal data allow us to look at the effectiveness of these specific characteristics over time.

The Sample of Teachers

We surveyed all the teachers who taught mathematics and

science in each of the 30 schools in the sample (i.e., all of the elementary-school teachers, and the middle and high school teachers who teach mathematics and/or science classes). We focus on mathematics and science teachers because they are the primary participants in Eisenhower-assisted activities. In elementary schools, we randomly administered mathematics surveys to half the teachers and administered science surveys to the other half. The three waves of the survey provide data pertaining to the 1996–97, 1997–98, and 1998–99 school years.

Description of the sample.
Four hundred thirty (430) teachers responded to the 1996–97 survey; 429 teachers responded to the 1997–98 survey; and 452 teachers responded to the 1998–99 survey.[9] (See Appendix B for a complete discussion of the response rates.) Some teachers who responded did not teach mathematics or science during the 1996–97, 1997—98, or 1998–99 school year, either because they were not employed as teachers in one or more of these years or because they taught other subjects, and thus they are not included in the analyses of classroom teaching. In addition, we excluded some teachers from particular analyses because they did not complete a minimum necessary set of items on the survey. For most analyses, we rely on the sample of 287 teachers who responded to all three waves of the survey. For some analyses (those focusing only on professional development experiences), we rely on a sample of 318 teachers who responded to at least the second and third waves. And for some analyses, we restrict the dataset to teachers who taught the same course in each of the three years of the study (n=207). The response rate for the first wave was 75 percent; for the second wave, it was 74 percent; and for the final wave in 1998, 75 percent. (See Appendix B for more details on sample sizes and response rates.)[10]

The sample is 74 percent female and 18 percent minority. Ninety-three percent of the sample are certified teachers. Twelve percent of mathematics teachers and 18 percent of science teachers in the sample are novice teachers, or teachers who have taught the surveyed subject for three or fewer years.[11] (See Appendix B for a more complete description of the sampling, response rates, design, and methodology.)

The data in this report are unique in that they provide detailed information on teaching practice and professional development over a three-year period for all teachers of mathematics and science in a school. These data enabled us to analyze relationships between teachers' professional development experiences and classroom practice, while controlling for prior differences in their classroom practice.

To set the context for examining the effects of professional development on instruction, in the next section we describe the professional development experienced by teachers in our longitudinal study.

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The previous excerpt is Section

I of the following document: U.S. Department of Eduction, Office of the Under Secretary, Planning and Evaluation Service, Elementary and Secondary Education Division, *Does Professional Development Change Teaching Practice? Results from a Three-Year Study, Executive Summary*, Washington, D.C, 20202.

Endnotes

1 See Richardson & Placier (in press) for a comprehensive review of the literature on teacher learning and professional development.

2 See, for example, Cohen (1990) for an intensive case study of change in mathematics teaching; Carey and Frechtling (1997) for a program evaluation of exemplary professional activities in science; and U.S. Department of Education (1999a) for a national survey of teachers focused on teacher preparation and qualifications.

3 See, for example, Fennema et al. (1996), an experimental study examining the effects of Cognitively Guided Instruction, an intervention in elementary school mathematics; Wilson and Ball (1991), an intensive case study of two teachers who participated in the Summer Math program; and Cohen and Hill (1998), which describes the relationship between participation in professional development, teaching practice, and student achievement, using survey data from California. See Kennedy (1998) for a review of available randomized studies examining the effects of teacher professional development on student achievement in mathematics and science. See Shields, Marsh, and Adelman (1998) for a recent examination of the effects of the National Science Foundation (NSF) Statewide Systemic Initiatives (SSIs) on classroom practice in mathematics and science; and Weiss, Montgomery, Ridgway, and Bond (1998) for an examination of the effects of the NSF Local Systemic Change (LSC) initiatives.

4 Kennedy (1998) and Cohen and Hill (1998) are among the few examples of studies that compare the relative effectiveness of different forms of professional development. Both studies conclude that professional development focused on the teaching and learning of specific mathematics and science content is more effective than more general professional development.

5 The mail survey of teachers represents a response rate of 72 percent of sampled teachers. Details regarding sampling design and methodology are provided in Garet et al., 1999.

6 We used poverty data from the Common Core of Data (CCD).

7 As part of our site visits to the 30 case study schools, we conducted one-time classroom observations of two teachers in each school—usually one mathematics teacher and one science teacher. In conjunction with the observations, we conducted a brief pre-observation interview and a somewhat longer post-observation interview with each of the 60 teachers we observed. The results of these observations are discussed in Garet et al., 1999.

8 The achievement data were collected from existing data at the sites. Scores were not always available for 4th and/or 8thgrade for every year. Where 4th and/or 8thgrade scores are not available, we provide the scores for the grades closest to 4th and 8th grade.

9 The response rate of high school teachers was higher than those of elementary and middle school teachers, perhaps because principals and department chairs in high school were more involved in administering the survey.

10 We compared responses from teachers who responded only to wave one, teachers who responded to waves two and three, and teachers who responded to all three waves and found no significant differences in gender, teaching experience, certification, poverty, and all of our measures of teaching practice. The one significant difference we found was that teachers who responded to wave one only were overrepresented in high-poverty schools, compared with those who participated in all three waves.

11 We asked teachers about personal background information, such as gender and years of experience, only in the baseline wave of the survey.